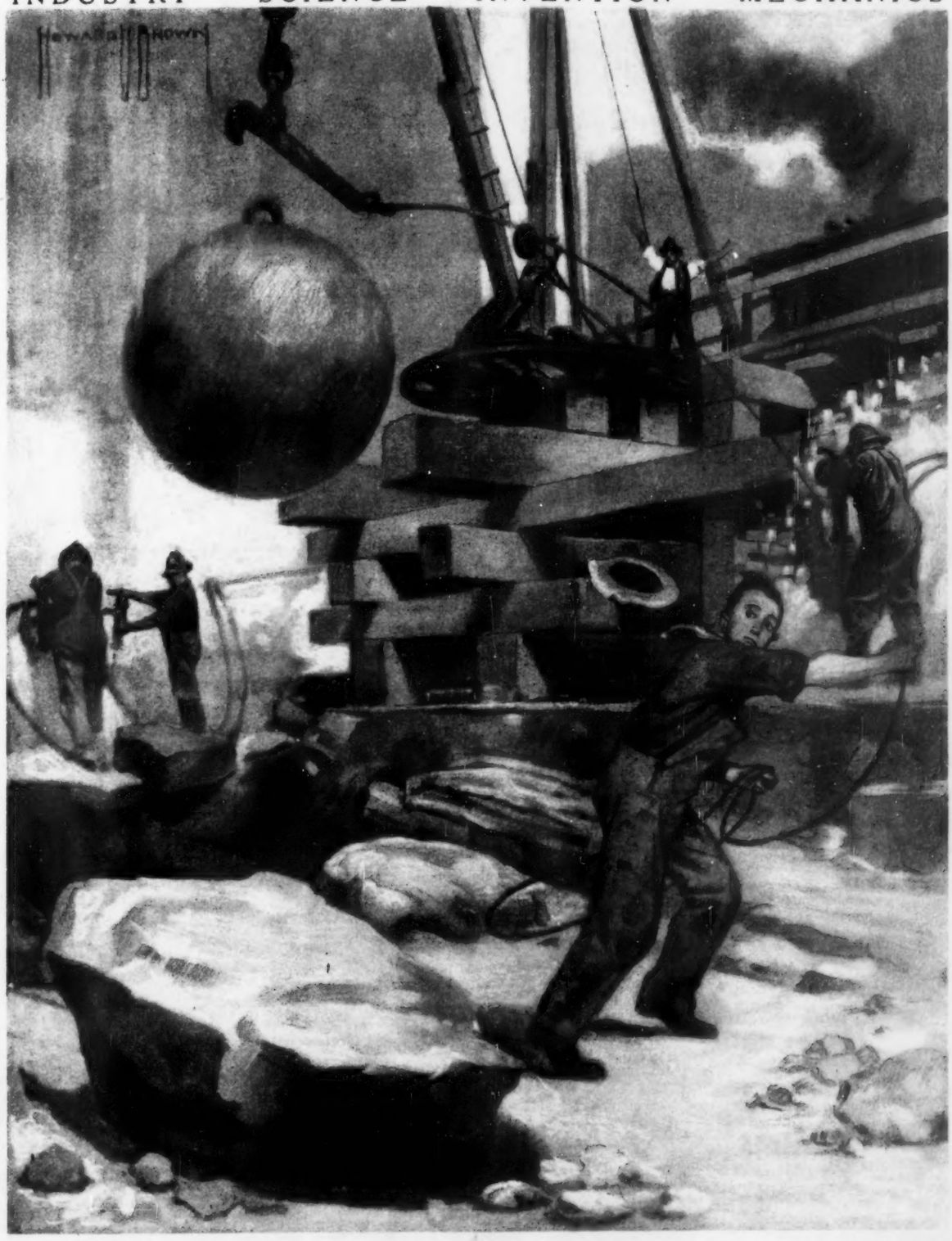
SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



BREAKING UP LARGE ROCKS WITH A FALLING IRON BALL.-- (See page 423)

Vol. CXXI. No. 17.
October 25. 1919

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 10 Cents
$5.00 a Year

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879

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Mileage you get as a matter of course when you buy 'Nobby Cord' pneumatic truck tires. It is part of your purchase. Their performance is guaranteed.

That is why there is *no mileage limit* in the 'Nobby Cord' guarantee.

Like all United States Tires—passenger car or truck—'Nobby Cords' are guaranteed to be free from imperfections in materials and workmanship, with no limitation of mileage.

But it is not mileage alone that counts. Nor is it the important savings in gas, oil, depreciation and repairs effected by these pioneer heavy-duty pneumatics.

The continuous and uninterrupted use of your truck—greater speed on the road—more work—increased business, which 'Nobby Cords' make possible, show up big on the balance sheet.

Any United States Tire Dealer will demonstrate how the use of 'Nobby Cords' will get this result in your truck service.

United States Tire Company

United States Tires are Good Tires

Firestone Engineering & America's Truck Tonnage

Providing the right truck tire for every road and load has been a Firestone responsibility since the first truck was built.

Good roads have been slow to come—but trucking has gone forward regardless.

Firestone, keeping pace with the trucking industry, has solved problem after problem, until trucks are hauling the great bulk of America's tonnage and are strong allies of the railroads in inter-city traffic.

Firestone engineers designed the first truck tire, and from that day to this the history of truck tire progress is Firestone history.

As the truck builders advanced they found Firestone ready, not only with the right tire but the right rim.

Firestone introduced the channel type of tire, the removable type, the cup cushion type, the giant type, the grooved tread type.

Firestone was first to build a complete line of truck tires—a type suited to every road, load and condition of service.

Firestone was first to establish adequate service dealers everywhere; over 600 now serving every trucking center in America.

Firestone was first with a practical, efficient giant cord tire equipment, including demountable rims.

And Firestone is the only manufacturer that makes the tire and the rim complete.

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Here they went beyond the tire and rim and designed a feature of wheel construction for truck makers, also a spare tire carrier device that makes one man able to change tires easily regardless of weight.

These examples of Firestone Engineering explain the success of the "Ship by Truck" movement.

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Today over half the truck tonnage of America is carried on Firestone Tires.

This is the reward of sound engineering; tires, tubes and rims of commercial perfection; service that is intelligent, adequate and on the spot.

Ship by Truck

Firestone

Most Miles per Dollar

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXI] NUMBER 17 NEW YORK, OCTOBER 25, 1919 [10 CENTS A COPY $5.00 A YEAR

A WORD ABOUT THIS ISSUE

THE SCIENTIFIC AMERICAN comes to its public this week in a condition greatly resembling that of the gentleman who finds his clothes mysteriously missing after taking a dip in the river, and who is forced by this calamity to pursue his homeward way clad in a barrel. There has been a serious question whether it would be possible to get out the issue at all.

As our readers have undoubtedly been informed by the daily papers, there exists a combined strike and lock-out of the New York local unions of pressmen, feeders, paper-handlers, etc. This has been brought on mainly by the failure of these unions in the past to live up to their contracts, and their announced intention of refusing to embody their present demands in the form of a contract - intending, frankly, to make further exorbitant demands whenever occasion offers, and to back up such demands by a peremptory walk-out. The attitude of these local unions has been so wholly irresponsible that their internationals have repudiated and expelled them; nevertheless they are supported in their present stand by concerted "vacations" on the part of the entire membership of certain other printing-trade locals.

The situation is further complicated by the fact that existing arbitration agreements expired on October 1st. Hence there is nothing outside financial pressure to prevent both sides from holding out indefinitely. The employing printers say they cannot pay the increase of $14 per week demanded by all the men who have gone out, and that they will remain idle indefinitely rather than attempt to do so; while the men are equally determined to stay out until they get this increase, with the 44-hour week. Both sides seem to mean business, and there is every appearance of an elegant knock-down-and-drag-out fight, with the publishers - those that have their own plants as well as those that have not - playing the role of innocent bystander.

The upshot of it all is that outside the daily papers which are not affected, there is practically no printing being done in New York. It is not merely that the pressrooms are idle; nobody can get any type set unless he yields to the demands of the pressmen and their supporters - but if he does so yield, the electrotypers will refuse to make plates for him, for they stand on the other side of the fence, in support of the internationals! So effective is this deadlock that almost all the publications that are manufactured in the metropolis have very frankly conceded without a struggle that publication is out of the question until agreement of some sort is effected; and, beginning with issues of October 4th., one after another of our contemporaries has relapsed into a state of hibernation. The SCIENTIFIC AMERICAN, however, has never missed an issue in its 74 years, and we do not propose to miss one now if there is anything we can do to prevent it. We made up our minds when the present difficulty was first threatened that we would not suspend publication until we had exhausted every remedy. Our preparedness enabled us to get out from one to three normally printed issues after other papers had had to throw up the sponge; and now we can no longer print, we are ready with a new resource.

The composition of the present issue tells its story; but it may not be out of place for us also to speak for it. The copy has been prepared by the editors on their trusty typewriters; and from this copy, photographic transfers have been made on a lithographic stone. Since the strike does not affect the lithographic pressmen, it has been possible to get out the issue on this unique basis. For some time our covers have been produced by the lithographic process in question, and frequent use has been made of it in preparing advertising booklets, etc.; but we believe that this is the first time it has ever been used in this manner, to produce the inside of an ordinary magazine, without color. It will be understood that in this process the entire page becomes in effect a single illustration, the type matter being reproduced from the typewritten original just as are the half-tones from the original photographs.

Of course the wider spacing of the letters, and even more of the lines, makes it possible for us to get, in a given space, only about half as much matter in this arrangement as ordinarily. In order to make the issue a fairly representative one, therefore, we have been forced to edit it very severely, cutting down some of the articles to a fraction of their original compass. So this issue is rather a capsule one, with the matter presented in highly predigested form.

We are well pleased with the ingenuity and the persistence that have enabled us to publish when so many of our contemporaries are silent. Doubtless too, many of our subscribers will want to preserve the present issue as a souvenir of a state of affairs that never was met before and may never be again. The issue will by all means constitute a curiosity of the printing trades, and one which should be of some value in the future. To give it even more standing in this direction than it otherwise would have, we present the editorial page in direct reproduction of the original long-hand manuscript in which it was prepared, with especial attention to the width of the column, by the senior member of the staff.

We expect to publish in the present form until the return of normal conditions, when we shall go back to our regular dress, none the worse, we hope, for the period of masquerade. In the meantime, we can only express our regrets for any shortcomings of the present issue, and our sincere wish that our subscribers get as much fun out of reading it as we got out of its preparation.

SCIENTIFIC AMERICAN
Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, October 25, 1919
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Folding Landing-Gear for Airplanes.

It has been estimated that sixteen per cent of the head resistance of an airplane is due to the landing-gear. Anyone who has watched the flight of a seagull must have noticed how carefully he streamlines himself by straightening out his legs against his afterbody. It may well be that this action of the birds suggested the possibility of doing something of the kind with the landing-gear of the airplane. It may be remembered that, some ten years ago, the editor of this journal suggested that the landing-gear might be hinged to the fuselage, so that it could be drawn up against the underbody by means of a connecting rod and piston, actuated by compressed air.

In the intervening years much thought has been given to this problem, and, today, there are several machines which carry folding landing-gears of more or less merit. Necessarily, these improvements have been confined to the smaller and lighter machines.

Another arrangement for cutting down head resistance is to reduce the depth of the landing gear, even to the extent of housing the wheels, or, rather, the upper half of them, within the fuselage. Although this is practicable in a light-weight machine, it would, of course, be dangerous in a heavy machine, such as the Handley-Page bomber. The necessarily small clearance, in a machine with partially-housed wheels, between the fuselage and the ground, would restrict the choice of a landing place, since, on any but a first-class surface, there would be danger of irregularities of the ground striking the underside of the machine

Bravo, France!

Thanks to insidious enemy propaganda, it has been whispered, here and there, that France was disposed to shirk the tasks of reconstruction and shift them to the shoulders of her Allies.

Now, those who know the French and their glorious past do not need to be told that this is a lie, as unjust as it is malicious. We have manifold evidence that this great people know how to bear reverses with national fortitude and dignity. Hence we are not surprised to learn from official sources that the courage and energy with which France faced the reconstruction problems of the Franco-German war are being shown in facing the infinitely greater problems that have been engendered by the great World war.

The devastated area in the north of France comprised some 4,500,000 acres of land which was totally unfit for cultivation, the rich top soil being buried, and the whole area furrowed with trenches and criss-crossed with barbed wire. Nevertheless, one million acres have been returned to the farmers and 500,000 acres are ready for seeding. Of 550,000 houses destroyed 60,000 have been rebuilt. Of the 3246 kilometers of railroads and 1675 kilometers of canals destroyed, 2106 and 700 kilometers, respectively, have been restored.

Printing of the Future

The compositors' walkout led to the appearance of this issue, in which the pages are typewritten and transferred to the stone by a photographic process. The attempt, somewhat crude tho' it be, suggests the ultimate elimination of composition and type-casting, with all the resulting economies. Some time ago the suggestion was made of using paper or metal signs, arranged in lines or columns, and photographed down to printing size. There is a long step between the present issue and the commercially practicable method of the future. Herein lies a promising field for research and inventive skill.

Astronomy

SPECTRUM OF NOVA AQUILAE. - The nova of July 1918, according to Re7. A. L. Courtie in the Monthly Notices of the R. A. S., has a triple spectrum. Evidence shows that besides a stationary spectrum, there is one indicating a line-of-sight recession of 1160 kilometers per second, and a similar one indicating an approach at the rate of 1340 kilometers per second.

MOTIONS OF NEBULAE AND CLUSTERS. - One of the many interesting facts to which recent studies at Mount Wilson bring attention is, that the brighter spiral nebulae as a class are receding from the sun and from the galactic plane. The reverse is true of most globular star clusters. These enormous stellar systems, as a class, are apparently approaching the sun at the rate of more than 100 kilometers per second. They now lie outside the vast system of stars to which our sun belongs, but appear destined to fall into this system.

THICKNESS OF SATURN'S RINGS. - Save for certain condensations at two places, the rings of Saturn, when turned edgewise to the earth, are beyond the reach of all except the very largest telescopes and of doubtful visibility in these. It is therefore evident that the thickness of these rings, at their effective albedo, is too small to render them visible as bright linear objects. Mr. Louis Bell cites several experiments on the limits of visibility of lines, which tend to prove that the main body of the rings cannot be thicker than 15 kilometers (9 miles). The condensations probably consist of exceedingly tenuous matter, visible only at exceeding obliquity.

THE BLINK MICROSCOPE. - The utility of this instrument as a means of detecting proper motions of stars, to which we have previously called the attention of our readers, is further discussed by Innes in Scientia. In comparing, with this means, plates taken 25 years apart, the smallest proper motion that can be detected is 1¼ second for the interval, or 5 seconds per century. According to Innes there are about three such stars over each square degree on an average, or 120,000 in the entire sky. It is estimated that the number of stars with sensible proper motions will increase with the square of the time interval considered. Accordingly, when plates taken at a century's interval are available, it should be possible to detect the proper motions of some two million separate stars.

Automobile

TEST TIRES FREQUENTLY. - When testing the air pressure in your tires, do not overlook the spares, which are often neglected. It is very aggravating to have a puncture, and find that the spare is flat; and it is far easier to inflate it with power compressor and air hose than by hand pump on the road.

SIDE PLATES FOR WHEELS. - The disk wheels recently offered to motorists are becoming more and more popular, so a recently developed accessory is a pair of light sheet-metal disks to be applied to the ordinary wood-and-wire spoked wheel to enclose it and give the appearance of the disked wheel. While this does not add appreciably to the strength of the support afforded the axle, it does give the advantage of thorough enclosure that facilitates cleaning.

CARBURETOR AIR CLEANER. - All good agricultural tractors are now fitted with air washers and cleaners to assure that no grit shall get into the cylinders through the carburetor. As a consequence of this, there is some interest in similar applications to trucks and passenger cars as well, especially when these are operated over dirt, gravel or macadam roads. Some of the cleaners operate on the centrifugal principle, others are of the water-washer type. The former is the more compact and will indubitably be employed on the lighter varieties of conveyance. This gives a very effective way of separating road dust from the air before it can get to the carburetor.

ACCESSORY LEAGUES. - The motorist should be warned against solicitors who are endeavoring to get subscriptions to or memberships in associations or leagues of various pretensions which purport to give members exceptional bargains in supplies for the motor car. As a rule the annual fee is small but the service extended by the pirates preying on legitimate commerce is so much smaller that no matter how low the charge for admission to their organization, it is an expensive investment. Catalogs are issued listing standard supplies at low figures, as a bait, but when these are ordered substitutes of inferior grade are usually supplied on the ground that the regular thing is "out of stock." This, however, will be found to be the normal condition; and the motorist will save money and trouble in the end by ordering from reputable firms that count the good will of the buying public an asset.

Aeronautical

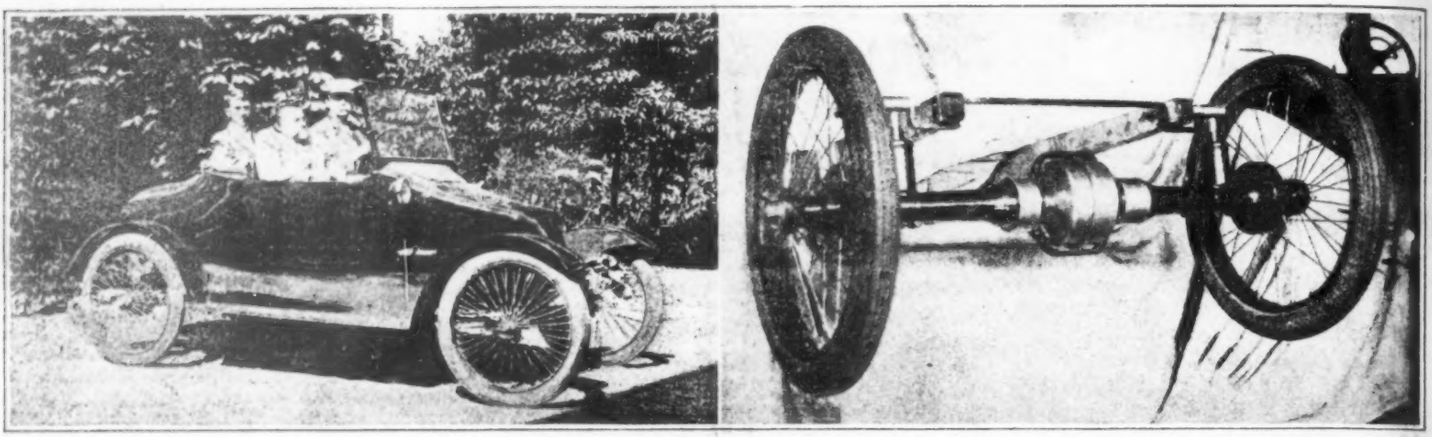
PARIS AERO SHOW. - The arrangements are now well forward for the sixth Paris Aero Show, which is to be held from December 19th, 1919, to January 4th, 1920, in the Grand Palais. It will be under the auspices of the Chambre Syndicale des Industries Aeronautique.

NO HUNTING FROM THE SKIES. - In the report of the Departmental Committee which has been considering the protection of wild birds in Great Britain, it is pointed out that a novel danger to bird life has been introduced, in shooting and bombing from aircraft. The Committee recommend that the use of aircraft against the wild birds be prohibited.

SILENT AIRPLANES. - Information emanating ultimately from Zurich is to the effect that several big German works, including Krupps, of Essen, are carrying out experiments in the most profound secrecy, with a novel aviation motor, much superior to all designs heretofore known. It is reported that they have constructed a gas turbine, one of the main advantages of which would be to give almost noiseless flight. Giant airplanes capable of carrying 64 people are stated to have been built with the motor in question.

ZEPPELIN AIR SERVICE. - Successful trial flights are reported as having been made by a great Zeppelin, driven by seven motors and able to carry 100 passengers, in addition to the crew. A berlin source states that this is intended to be the first gun in a regular airship service by a German company, connecting Stockholm and Copenhagen with Berlin, the major object being the assumption of a leading position in Scandinavian affairs, as against British and French rivals.

BUSINESS USE OF PLANES. - A London journal is trying to show the vital everyday needs of business that may be met by use of the airplane, and has sent a representative on a flying trip over the British industrial areas. As he goes on a commercial mission and will visit leading local firms wherever he lands, his undertaking is expected to prove beyond doubt that the airplane is of immediate utility for getting business and of great advantage in extending and accelerating the travels of salesmen and others. It is said that this bold plan will appeal very strongly to British industrial and trading interests.



NEW ELECTRIC VEHICLE THAT WEIGHS 1000 POUNDS AND POSSESSES MANY UNIQUE FEATURES, AND THE REAR AXLE OF THE CAR

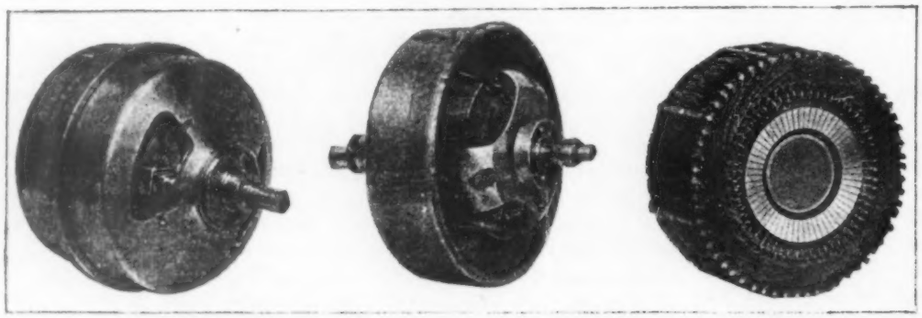
A FRESH DEAL FOR THE ELECTRIC CAR

GETTING MORE MILES OUT OF A GALLON OF GASOLINE

An ornate chariot travelling at the leisurely pace of 15 miles per hour; a storage battery that runs the car for only 35 miles, after which it is necessary to recharge it; low mileage at high cost; a heap of trouble in the form of batteries that must be watched and nursed lest they get discharged below the safe point or run out of water; a car that, so to speak, is chained to one's immediate locality because of the recharging problem - that, in brief, is the average man's idea of the electric car It is difficult to argue to the contrary; for the average man knows the electic car of bygone days only, and insists on comparing this with the gasoline car of 1919.

So the average man is asked to consider these points: A car that makes 25 miles an hour and even more; a car that can go anywhere, because it carries its own recharging plant; a car that generates current whenever it coasts downhill; a car that carries improved storage batteries, requiring the minimum of care; a car wherein the motor and transmission members, forming one unit, can be taken off in one block for inspection, repair, or even replacement. These features are all to be found in the latest electric car - one which seems likely to give the electric car a new deal in the automobile game.

The car in question has been developed over a period of many years by Harry E. Dey of Jersey City, and has the hearty endorsement of Dr. Charles P. Steinmetz, the well-known electrical engineer. The most revolutionary feature of Mr. Dey's car is the motor in which both armature and field magnet are rotatable, one element being connected to one driving wheel by way of a pair of reduction gears, while the other element connects with the other wheel in similar manner. It is in this way that the designer dispenses with differential gears; the motor with its independent rotation of parts makes a perfect substitute. In addition to saving the expense and weight of a differential gear, this construction cuts the number of parts and increases the capacity of the motor 100 per cent for a given gear reduction. This reduces the weight 50 per cent for a given power, and also increases the electric efficiency. The size of the motor is still further reduced by turning it inside out, as it were; that is to say, the armature, in the form of a Gramme ring, encloses the field magnet, permitting the latter to have six poles all energized from one field coil. This field is of a design ideal for efficiency and light weight, its weight, including shaft, totalling but 19¼ pounds. Its iron portion is well adapted to drop forging and easy machining. The total weight of the motor which has a capacity equal to the ordinary automobile motors of 150 or more pounds, is only 50 pounds.



MOTOR OF THE ELECTRIC CAR, SHOWING EXTERIOR AND INTERIOR DETAILS

The motor is mounted at the center, and on the center line of the axle. An eccentric of 7/32 throw is mounted on the outer end of each shaft; an internal gear is supported by and rotates on the field-shaft eccentric, a roller bearing taking care of the friction; an external gear, mounted concentric with the shaft and keyed fast to the stationary housing, meshes with the internal gear; the latter connects, by means of a flexible jointed shaft, with the wheel hub. This last connection is practically a floating axle.

It will be noted that but one of the gears is rotatable, the other being held absolutely rigid. At the armature end the construction differs by mounting the external gear, in place of the internal one, upon the eccentric, and keying the internal one to the housing. From this point the construction is in duplicate of the end described.

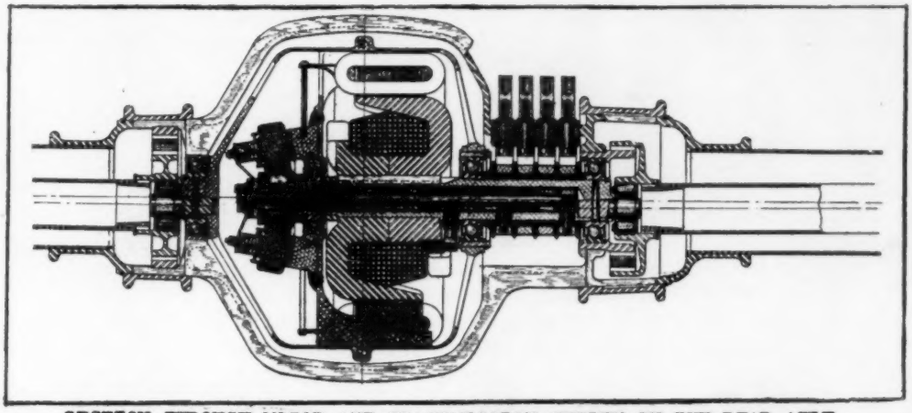
When the internal gear is the rotative element, as at the field-shaft end, the direction of rotation remains unaltered between the motor and the wheel With the external gear rotating, as at the armature end, the direction is reversed. The opposing directions of the armature and the field are thus rectified without recourse to any intermediate gears. This gearing, although somewhat difficult to understand for the uninitiated, is extremely simple in operation and cheap to manufacture. The

internal gears are 3½ inches, pitch diameter, and the external type are 3 1/16. These givea reduction ratio of 7½ to 1. On first consideration one might think that these gears would be too small to be serviceable; but because the two are so nearly of the same diameter, with one inside the other, there are at all times a large number of teeth in mesh, thus dividing the stress, rolling together without rubbing action, providing a strong tooth form, and running with absolute quiet. The efficiency of this arrangement is said to be high.

Caps covering the gears hold the power plant in place, while an aluminum cap covers the motor. These caps are held in place by a pair of taper rings that can be removed in less time than would normally be consumed in removing a single bolt. In this fashion the entire outfit can be dismantled in about two minutes. This car may well be called the "nutless" car, as remarkably few of these are used in its construction. As the current is taken to the motor through sliprings there is no necessity for disconnecting any wires when removing it. In case of an accident to the parts, another motor or gearing can be got at the service station, and exchange effected in a few minutes.

The first car built by Mr. Dey was equipped with hand-operated control, in connection with a steering wheel. It was found, however, upon testing this arrangement in heavy traffic to be an undesirable combination;for in an emergency both hands are required on this wheel and in addition there is a time element involved in shifting the hand from wheel to control lever. In the latest design the operation of the control is similar to that met on a gas car. For speed variation a foot lever acts in the same way as a clutch, with the added feature that pressure beyond that to cut the current off impels the motor to act as a brake, while extreme use of the foot power applies the mechanical brake to the driving wheels. In addition there is an emergency brake. An accelerator pedal raises the speed to 30 miles by weakening the field. A third pedal gives forward, reverse and neutral. This is so interlocked with the speed pedal that it can be moved only when the latter stands in a high resistance or the off position.

The steering wheel is hinged to permit of tilting wneh entering the car. The post is inclined at an angle of 30 degrees from the horizontal, giving the car a racy appearance. All this is mentioned here to convey some impression of the lines of this car, differing so materially from the bulky effect of most electrics.



SECTION THROUGH MOTOR AND TRANSMISSION SYSTEM ON THE REAR AXLE OF THE NEW ELECTRIC CAR

Coming to the chassis, we find this made of wood with truss rods beneath. The battery is carried underneath the floor, and attached to the truss-rod posts. This leaves the body entirely free of encumbrances, and permits it to be utilized entirely for passengers and luggage. It also avoids the troubles, due to acid spray and spilled electrolyte, so common to the usual electric. The method os suspension is such that the battery can be readily lowered to the floor of the garage, while by lifting a trap door in the floor of the car, it is easily accessible for adding water. The location of the weight thus obtained is ideal from the standpoint of low power consumption, comfortable riding and safety.

A radical departure has been made in the spring suspension, as air springs have been substituted for the elliptical type. These are the same in principle as those employed for many years on the cushion-frame bicycle. The construction is similar to that of a tire pump, with the addition of a helical spring inside the cylinder. The spring takes care of the static load, while the air takes up all the shocks. A small air leak does no injury, for the spring will bring the load back to its normal position and the air will return, in the same way it went out. Above the piston there remains a space in the cylinder where air is compressed on the rebound.

While Mr. Dey is a strong advocate of light weight, he does not believe in getting it at the expense of safety or travelling radius, his idea being that 50 per cent of the total weight should be charged to the battery. This would provide power in excess of 100 miles per charge. On this basis, for every pound's weight saved in the car an additional pound will be saved in the battery; thus one pound saved is truly two pounds earned. The total weight of the rear axle, which would include practically the entire power plant, is approximately 100 pounds. The air springs save sixty pounds. The wood frame accounts for 50 pounds or more of weight saved; and these are but a few of the many weight economies that are effected throughout the design of this super-electric car.

Mr. Dey has largely increased the scope of his car by designing a portable charging plant, weighing approximately 100 pounds, to be carried under the bonnet of the car. It consists of a light 3-horse-power air-cooled gasoline engine connected to a special dynamo. It will charge the battery at any time, whether the car be running or standing, at a rate equal to the normal consumption of the driving motor, which experience has shown to be two horse-power This plant causes a net saving in the weight of the car of more than 100 pounds, due to the fact that one half the battery can be dispensed with, a 50-mile battery radius then being sufficient. If desired the plant may be removed from the car to be used as a stationary unit for recharging, as well as for charging a separate battery for house-lighting, etc. It is a simple matter to place the power plant in the car against a long trip. The smaller battery required will largely cancel the additional cost of the charging plant.

According to Mr. Dey there will be a large saving in gasoline expense as compared with the gasoline car, since in the electric car as here developed the engine is continuously operated at the maximum-efficiency load. Gasoline cars are admittedly wasteful, because their average load hardly exceeds one-tenth of their engine rating. From careful calculations, Mr. Dey estimates a saving of 50 per cent in fuel mileage, using his gasoline-electric system.

PRESERVING WITHOUT SUGAR

A STUDY OF THE ANTISEPTIC PROPERTIES OF COLD WATER

EVER since the civilized portion of mankind abandoned a nomadic life and settled down to raising crops, the effort has been made to preserve some part of those crops for use during the bitter months when the earth is iron and the sky is brass. Methods of preserving fruits and vegetables fall into certain definite classes. They have been dried by the heat of the sun, by artificial heat, and in modern times by evaporation in a vacuum. They have been frozen, or else preserved in cold storage, the latter method being considered at present not an unmixed blessing, because of the artful aid it lends to the designing profiteer. Finally, a large variety of antiseptics have been employed, those most widely used being salt, sugar, and alcohol. Something more than a century ago various men of science advanced the theory that the essential cause in the alteration of plant and animal tissues was contact with air or with the oxygen contained in the air, and a number of patents for preserving food based upon this idea were taken out, in fact, both in France and in England.

It was not until the brilliant researches of Pasteur demonstrated the existence of microbes throughout the realm of nature, that it was realized that these constitute the true cause of fermentation and decay, and that the exclusion of the air was effective merely because it involves the suppression of these germs. Empirically, however, this method of preserving fruits and vegetables by keeping them from contact with the sir, has been practised in various places with a considerable degree of success. Thus it has long been the habit in Italy to conserve tomatoes by placing them in vessels filled with water upon which a layer of oil is floated, and, similarly, green beans have been "put up" in France by placing them after washing in jars filled with water and then sealed hermetically.

The serious shortage of sugar during the war -- since the most usual method of preserving fruit consists in the combination of heat and sugar -- suggested to a French savant, M. Gabriel Bertrand, the desirability of making a detailed study of such sugarless methods with the object of determining their reliability and the scientific basis of their operation. The results he obtained combined both scientific interest and enormous practical value, proving as they do that it is possible to preserve various fruits in perfect condition from six months to a year in cold water alone, without the addition of either sugar, alcohol, or any other antiseptic agent.

The fruits experimented with included cherries, raspberries, red and white gooseberries, plums, quinces and apricots, the latter being sliced as well as whole. Tests were made with spring water both boiled and unboiled, and with distilled water, various systems of sealing the jars being employed. M.Bertrand made his experiments in July and August of 1918, and forty-two jars of fruit were prepared, the jars being the ordinary ones obtained commercially.

(Continued on page 431)

THE FUSION OF TUNGSTEN

A NEW GERMAN PROCESS FOR WORKING THE OBSTINATE METAL

THE metal tungsten was discovered in 1781 by Scheele. It melts at about 3000 deg. Centigrade and has a specific weight of about 18. On account of its high melting point it has not been fused with any success, but is ordinarily produced only in the form of a powder. In this form it is employed to form tool-steel alloys of extreme hardness and temper.

The valuable properties possessed by metallic tungsten can be observed in the small particles obtained in the laboratory. It has been generally realized that an extensive and profitable industry might be developed were it possible to produce the metal in a regularly fused condition, and to bring it by casting, forging, or pressing into convenient forms. The great chemical and electrical firms, especially in Germany, have spared neither trouble nor expense in attacking this problem; but for more than a decade these were without success.

Up to the year 1912 all that was accomplished was the formation from powdered tungsten of rods by means of high pressure; these were then further consolidated through the partial fusion at as extreme a temperature as possible. From this material the well-known tungsten wire for electric lamps was made. Since these wires are thus not of pure fused tungsten, however, we cannot feel that the valuable properties of the metal are fully employed therein.

During the years 1911-13 Hugo Lohman, a Berlin engineer, attacked the problem anew; and, according to a long statement bearing his signature in Elektrochemische Zeitschrift for February-March, he succeeded in fusing and casting metallic tungsten; so that it is now possible to employ this metal for a wide variety of purposes. Some of these he enumerates.

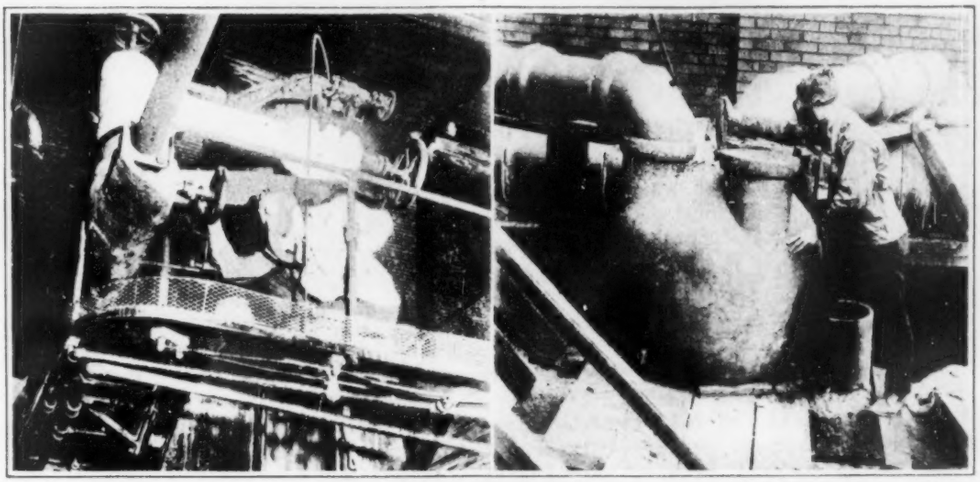
Tungsten in the form of the carbide has an extraordinary hardness, no less than 9.8 on the Moss scale wherein the hardness of the diamond is represented by 10. It is sufficiently well known that many million marks worth of diamonds are sold yearly for industrial purposes; they are employed in manufacturing tools of all sorts, such as wire-drawing dies; as grinders for auger points, deep borers and stone saws; in the form of dust as aids to these operations; as glass-cutters, etc. Herr Lohman considers that tungsten carbite is destined entirely to supplant the diamond in such applications. Even today it is extensively used in place of the diamond in wire-drawing dies; and in other cases the manufacture of the carbide and its substitution for the diamond is an accomplished fact. During the war he suggests that Germany found its use a decided relief from the shortage of rough diamonds. The processes involved are protected by a number of German patents issued or applied for at the present writing.

Fused tungsten can be cast in the form of pipes, crucibles, or any shape desired. It is very resistant to acid, not being attacked even by boiling aqua regia, which quickly dissolves all the "noble" metals, including gold, silver and platinum. As a consequence the manufacture of acid-proof vessels for chemical purposes ought to find a very wide market. The high melting point also suggests the employment of tungsten in

(Continued on page 422)

THE GAS MASK IN INDUSTRY

THE BUREAU OF MINES TELLS WHAT IT WILL DO AND WHAT IT WILL NOT DO



THE BUREAU OF MINES TELLS WHAT IT WILL DO AND WHAT IT WILL NOT DO

During the war upward of three million American soldiers were trained in the use of gas masks and shown that they would give complete protection from all the poisonous gases used in warfare. Of these soldiers, most have now returned from overseas and resumed their former civilian occupations. Having become familiar with the life-saving qualities of the gas-mask, they are now demanding protection, in the industries in which they are at present engaged, against toxic and suffocating gases similar to those they had to contend with during the period of service at the front. In other words, they want their gas masks back.

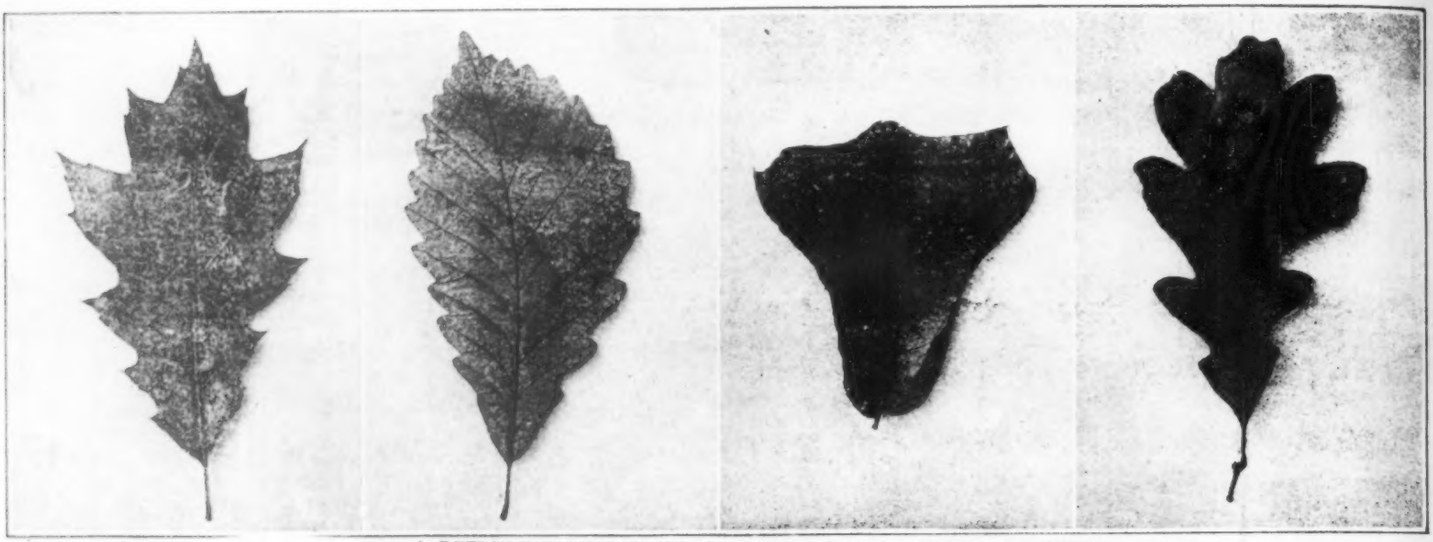
To meet this demand Uncle Sam has established a gas-mask department at the Pittsburgh Experiment Station of the Bureau of Mines. Experiments in the industries by members of this station have most conclusively shown that the requests of the soldiers are sensible. The army gas mask has been proved to have a very wide application in protecting workmen from the noxious gases and fumes that are given off in dangerous chemical operations, and, more especially, in cleaning out and repairing towers, tanks and chambers in which have accumulated sediments or sludges emitting irritating and toxic fumes.

Examples of such uses are in clean-out the Gay-Lussac towers, niterpots and chambers of sulfuric acid plants Good protection, it has been found, is also given workmen by the masks against the oxides of nitrogen and sulfur dioxide, and they have proven very useful in pyrite smelting and roasting operations. A large industrial demand for the gas masks has emanated from the workers in plants using chlorine and chloride of lime, as for example factories using bleaching material, pulp and paper factories, chlorination operations and water purifications. There have also been numerous inquiries from workmen and employers regarding the use of army gas masks for protection against various organic vapors. Trial has proven the mask useful in those cases in which the fluid did not have excessively high vapor pressure. Successful test was made by the workers at a by-product coke plant, in entering a large benzol washer immediately after it had been emptied. Workers in rubber factories have used the mask with effect against such volatile solvents as carbon disulfide, carbon tetrachloride, and sulfur chloride. Many uses of this nature could be cited.

But the largest demand so far for army gas masks has arisen from city fire departments. The need of a simple smoke-filter has been a long-felt one in fighting fires. Many experiments have shown that the gas mask is an effective smoke protector. Unfortunately it is not operative against the carbon monoxide met sometimes in fires. On the whole, however, it has been shown very useful for protection from smoke and chemical fumes alone.

(continued on page 426.)

TURNING GAS MASKS TO INDUSTRIAL USES:
Left: In handling nitric acid. Center: In mine rescue work. Right As a protection from turpentine fumes and paint spray.



A REPRESENTATIVE GROUP OF OAK LEAVES OF DIFFERENT TYPES
From left to right, they are: Red Oak, bristle-tipped with lobed margin; Rock Chestnut Oak, devoid of bristles and with crenate dentate margins; Black-Jack Oak, bristle-tipped with lobed margin; White Oak, without bristles, but with lobed margin

THE STORY OF THE BARTRAM OAK

HOW A LITTLE EXACT EXPERIMENTAL SCIENCE SOLVED A PROBLEM OF LONG STANDING

By Dr. Arthur Hollick, New York Botanical Gardens

The oak trees of the world, regarded as a botanical aggregate, include some 200 species, with distribution throughout the northern hemisphere, about 50 being native to the American continent. They vary greatly in leaf character, some being broad and lobed, others toothed or crenate and the rest narrow with entire margins. Biologically, the genus may be separated into two well defined groups, those perfecting their acorns in the autumn of the year wherein they are fertilized, and those which do not do this until a year later. Incidentally, the lobes, tips and teeth of leaves in the latter group terminate in slender bristles, whereas the leaves of the first group are wholly devoid of bristle. Furthermore in recent years it has been proven that certain of the species in each group are able to cross, but that cross-fertilization between species of the same set does not occur. The hybrids so produced are in the most part intermediate in their characters between those of the two parent species; and these forms have been the cause of many discussions and differences of opinion in regard to whether they are actually hybrids, or varieties of recognized species, or even species distinct in themselves.

Some time prior to 1750 a single tree of the above controversial possibilities attracted the attention of botanists and other observers of natural phenomena. It was growing on the bank of the Schuylkill River, upon the farm of John Bartram, at Kingsessing, now included within the city of Philadelphia. Those who had seen it failed to identify it with any known species, or so we may infer from a letter to Bartram, written by the English botanist Peter Collinson, asking for acorns in order that he might attempt to duplicate the strange tree in his garden.

So far as published records show, this was the only tree of its kind that was known at the time, or for a hundred years subsequently. Nor is there any record that it was identified, named, or described by any of the botanists of the eighteenth century; and it was not until the early part of the next century that it was first described, and figured, and given a name of its own. This was done by the French botanist and explorer, F. Andre Michaux, in his "Histoire des

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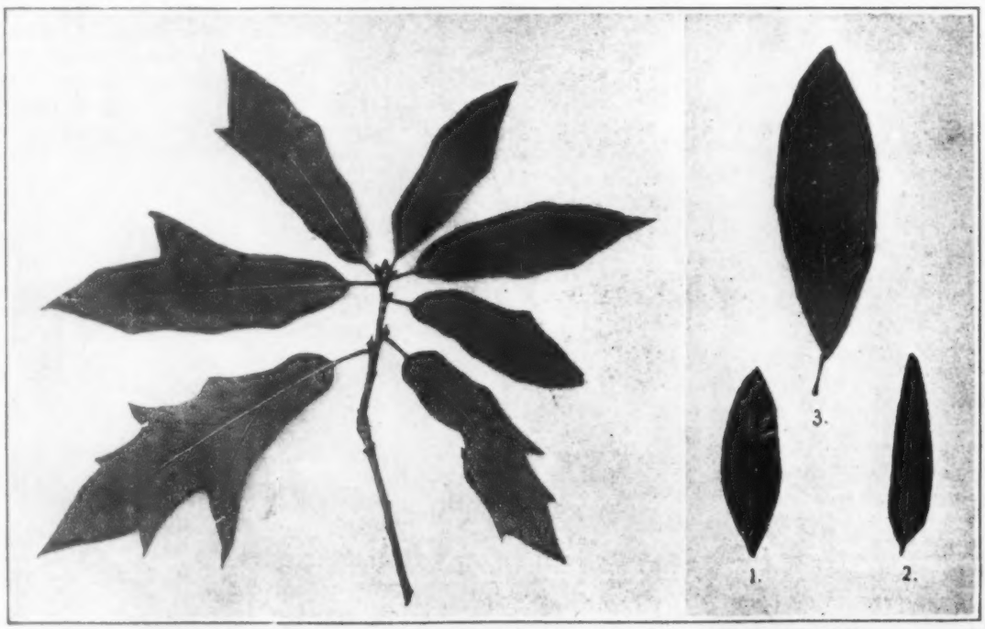
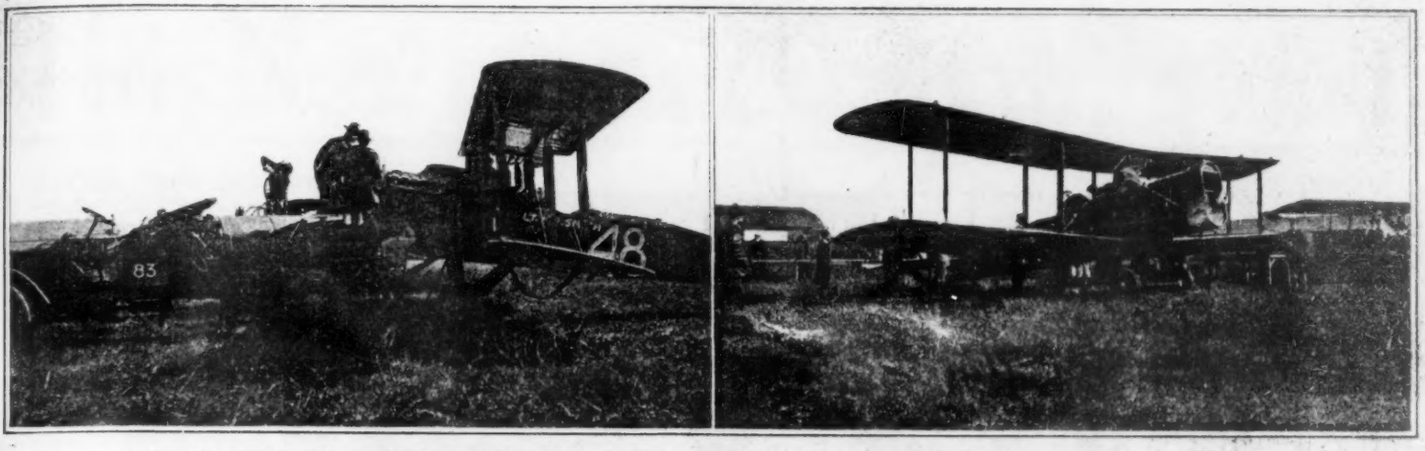


LEAVES OF THE BARTRAM OAK (LEFT) AND OF THREE OTHER SPECIES
Of the latter, (1) is the Laurel Oak, (2) the Willow Oak, and (3) the Shingle Oak. All three are examples of entire-leaved oaks of the bristle-tipped group



ONE OF THE RACERS REFILLING HIS FUEL TANKS, AND A DE HAVILAND ENTRY AT A CONTROL STATION

THE TRANSCONTINENTAL AIR RACE

An Army Contest Designed to Promote Commercial Aviation

As we go to press there is drawing to its close a notable airplane contest across the United States, which may be considered the counterpart, overland, of the race across the Atlantic which took place earlier this year. The contest was promoted by a joint effort of the Army Air Service and the Flying Club of America. Although preeminently a sporting event, its purpose was distinctly serious and practical, since it was proposed for the purpose of stimulating interest in aviation - determining the best route for transcontinental travel, gathering information as to the best location of landing fields, and adding to our store of knowledge of the meteorological conditions existing over the route that was taken.

Looked at from a military point of view the contest has been defined as "a military maneuver to demonstrate how long it would take to transfer one or more squadrons of military machines across the continent in either direction." A glance at the accompanying map will show that the course ran in a fairly straight line from east to west, with Mineola and the Presidio at San Francisco for the starting and the finishing points.

The contest was open to the world and the list of entries included 65 machines. Of these by far the larger number started at Mineola, this for the reason that a majority of the Army flying fields is to be found in the eastern states. By the rules of the contest a stop of 30 minutes was to be made at each of the landing fields. There was to be no night flying except where conditions rendered it necessary in order for the flyer to make his next landing field. The total distance across the continent by this route is 2710 miles. When the crossing, one way, had been made the aviator was to remain on the ground for not less than 48 nor more than 96 hours. The race was started on October 8th from both ends of the course, and although the greater part of the men took the air on that day, they were permitted to start on subsequent days if they so preferred.

The list of entries shows how enthusiastically the army responded to the call for this test of skill and endu-

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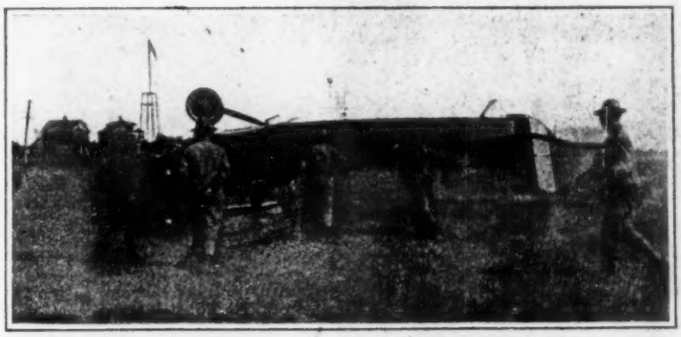
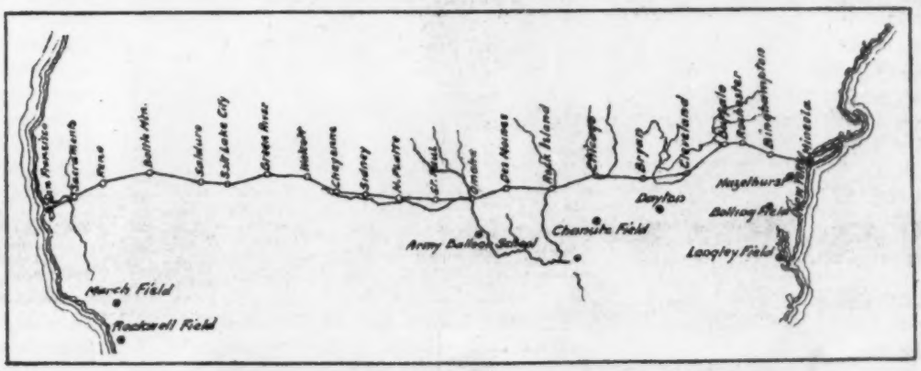


THIS IS THE SORT OF THING TO WHICH THE NEWS OF THE DAY REFERS AS A "BAD LANDING"



THE COURSE OF THE BIG RACE, SHOWING THE CONTROLS

SMASHING ROCKS WITH A FALLING WEIGHT

The use of explosives is always connected with the breaking of rock. Blasting is the modern way; but blasting does only part of the work. There remains yet the task of breaking up the large pieces that result from the explosion, into smaller pieces that can be conveniently handled and carted away. And it is in the breaking up of such fragments that much labor has been expended in the past.

It has remained for some ingenious contractor to introduce a new method of doing this by means of a falling weight. This method which forms the subject of our cover illustration consiste merely in elevating an iron ball weighing about 3500 pounds about ten feet above the rock to be smashed and then releasing the ball so that it can fall on the rock. The ball is raised by means of the usual derrick and carefully placed over the rock to be broken up. At the opportune moment it is released by tugging a rope connected with a simple hook arrangement. With one blow the huge ball breaks up a rock into several moderate-sized pieces ready to be loaded up and carted away.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A HOBBY HORSE FOR SKATERS

THERE is hardly a more fruitful field for the prolific inventor than toys. Indeed, some of the most successful inventions have been in the form of ingenious toys -- toys that are simplicity itself, yet introduce some new game or play for children.

Among the most recent toy inventions is the hobby horse for juvenile skaters. This little device consists of a stout stick with wheels at the lower end, a cross stick serving as handle at the upper end, and a small seat. With this hobby horse the little skater finds new interests in his sport.

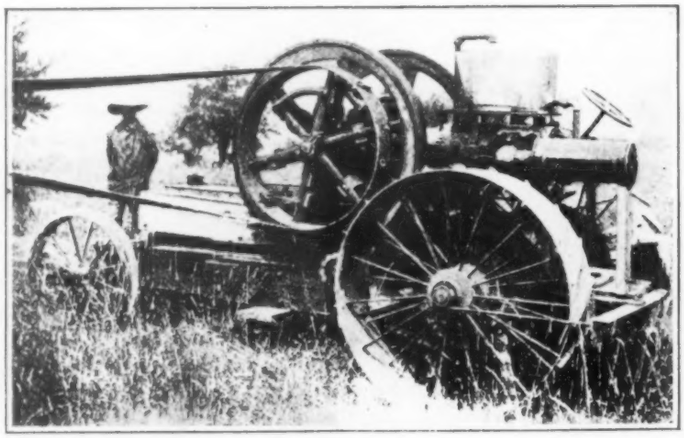
TWO VIEWS OF THE WHEELED HOBBY HORSE FOR SKATERS

A GASOLINE TRACTOR OF THE HOME-MADE VARIETY

A fifteen-year-old one-cylinder engine bought at public sale nine years ago and in constant use ever since furnished the inspiration and the foundation for a very interesting home-made tractor which cost, in actual cash, no more than $265. The farmer whose mechanical ability led to this result is Abraham Geissinger, of Hosenack, Lehigh County, Pa. We illustrate the tractor which he assembled from this engine and the scrap pile.

The machine develops 12-horsepower at a speed of 3 miles an hour. Its builder has used it with complete success for treshing, and has hauled as many as three plows with it. It climbs the steepest hills in the neighborhood roads without a balk; and on the whole, it is estimated that it does on Mr. Geissinger's farm the work of four horses.

As a matter of fact, the cost of $265 mentioned is a liberal figure; for this includes the full price paid for the engine in 1910. Obviously, there should be some depreciation charged against this, bringing the cost of the machine down even lower. Nor is the finished tractor a crude affair, as the picture will show. For an object lesson in junk utilization it surely presents a very fancy appearance.



HOME-MADE GASOLINE TRACTOR EVOLVED FROM THE JUNK PILE

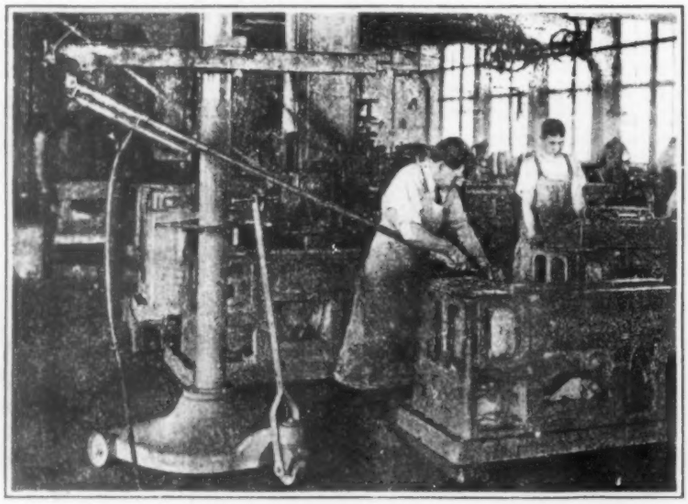
PNEUMATIC SCRAPING MACHINE

A pneumatic scraping machine has been developed at Rockford, Ill., whereby human muscle is replaced by mechanical energy. This pneumatic power scraper is so well thought out that it not only relieves the operator from exhaustion, and does three times as much work, but sacrifices none of the fine "human touch" so essential in obtaining excellence of finish.

It will be seen that the scraper blade is fastened to the rod by means of a screw, and is readily removed for sharpening. The rod that carries the blade is mounted on a ball-bearing pivot, which allows the scraper blade to turn so both sides of it can be used, same as a hand scraper; also to conform to the work regardless of angle.

In operation a slight movement of the right hand, which grips the valve control, causes the forward stroke; and slightly releasing the hold on the valve causes it to return for the next stroke. The length of stroke is determined by the operator, according to the requirements of the work.

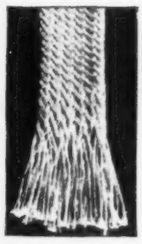
These pneumatic scrapers have either stationary or portable bases. The bracket that carries the I-beam can be moved up and down, or swung into any position desired, and clamped by a screw. The small bracket on top, which carries the counterbalance chain, is



PNEUMATIC SCRAPING MACHINE THAT SAVES TIME AND MUSCLE

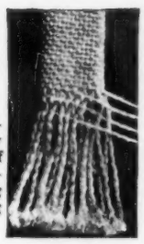
(Continued on page 435)

This New Electric Cord withstood 80 Hammer Blows against 5 for ordinary cable



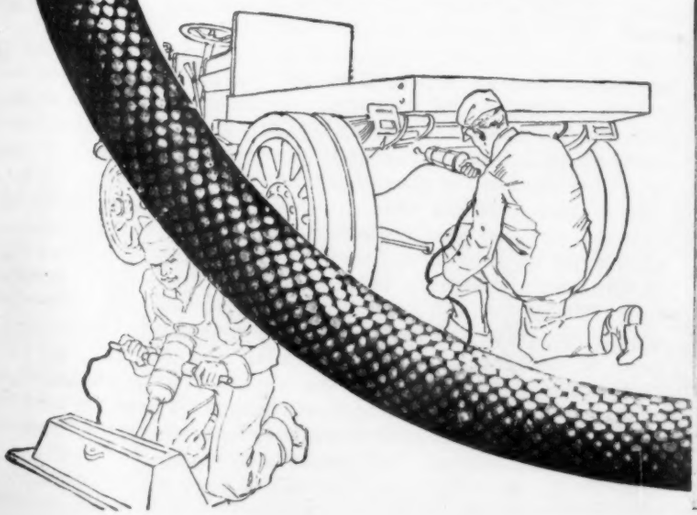
This is ordinary braided cable covering. Note the open and porous construction, easily cut, stretched or unravelled.

Compare it with the Duracord covering. Thick, heavy strands, *woven* like a piece of fire hose, *not braided*. Illustration shows outside covering only without impregnating compounds.



Test it yourself

A request will bring samples of braid covered cable and Duracord for your personal comparison and test.



~and both were subjected to identically the same test.

DURACORD

TRADE·MARK

is a *different* kind of a portable electric cord made for hard service and rough usage. It has a special cover of heavy, fine quality cotton *woven* like a piece of fire hose. *It is not braided.* (See illustrations.) It has all the electrical strength of ordinary braid covered cord and many times the mechanical strength.

Ship yards, factories, industrial plants, railway shops, theatres, moving picture studios and a hundred and one other users of portable cord are standardizing on Duracord.

If you are a user of portable electric cord and don't as yet know Duracord we will gladly send samples and literature without obligation.

If you are a jobber or dealer and are not handling Duracord let us tell you of its wonderful sales possibilities. Made in all sizes for every purpose.

Ask your electrical jobber about Duracord or write us.

TUBULAR WOVEN FABRIC CO.
Pawtucket, R. I.

Makers of Duraduct
Flexible Non-metallic Conduit

THE GAS MASK IN INDUSTRY

(Continued from page 421.)

Railroad engineers and firemen, in passing through long smoke- and gas-filled tunnels, have frequently felt the need of protection; and recent experiments by some of them with army gas masks have demonstrated that they fill the bill satisfactorily.

Taken all in all, Uncle Sam's investigators are of opinion that probably the modification of the army gas mask for ammonia fumes has been to date the most generally useful application of these masks in the industries. Ammonia refrigerating plants are wide-spread and leaks are of common occurrence. The special Chemical Warfare Service ammonia canister has met with unqualified success wherever tried.

On the whole, the army gas mask, now that its service in war is done, is rapidly finding its proper place in the industries. It has not yet met all the requirements, especially in cases where the workmen must wear it for long periods of time; experience has shown that they simply will not keep any kind of a mask on continuously if they can possibly get along without it. But for short periods and in emergencies it has proven very useful, and there is every indication, now that its possibilities are generally understood, that much improvement in design for industrial use may be expected within the next year.

The latest type of army Tissot gas mask is superior to the mouthpiece mask, used earlier in the war, and should be preferable for industrial use where confort to the wearer, visual acuity and ability to do continuous work over a period of several hours are essential requirements. The mask must fit the face very closely or leakage will occur, though in the latest designs this leakage is trifling and does not inconvenience the wearer until the external concentration becomes relatively high.

Although leakage through the face-piece of a mask of the mouth-piece type does not affect the throat and lungs, it irritates the eyes more readily than in a Tissot mask, as the accumulated gas is not swept out by breathing. In fact it is this eye irritation from leakage that determines, in many cases, the maximum concentration in which a gas mask can be worn.

A Tissot face-piece affords more protection to the eyes than any of the goggles that are usually employed with mouth-piece respirators, and gives much less trouble from dimming. Many of the standard army types of mouth-piece masks, however, will no doubt find their way into the industries; and for intermittent and emergency use, in periods of one hour or less the discomforts incident to the mouth-piece and nose-clip can be endured and this type of mask will doubtless find considerable use.

The army canister containing a mixture of charcoal and soda-lime is solely designed to give protection against the gases of warfare. Maximum protection from individual gases is sacrificed for general protection against all; but fairly good protection is nonetheless provided against a goodly number of substances.

The cotton-wadding pads in the army canister serve as filters and remove irritating liquid and solid particles such as are formed on spraying silicon, titanium, or tin tetrachlorides into air containing water vapor. Very finely divided particles such as tobacco smoke or sulfur trioxide are not completely removed. The degree of penetration increases with the velocity of the flow through the filter. The standard army canister provides no protection against ammonia fumes or carbon monoxide; it is therefore useless around blast furnaces, gas producers, against illuminating or natural

(Continued on page 428.)

THE GAS MASK IN INDUSTRY

(Continued from page 426.)

gas, or in coal mines after explosions or fires.

Hence for all industrial purposes it has been found necessary to design a filling for the specific gas in which the canister is to be used. An all-charcoal canister is now used for gasoline vapor, benzol, carbon bisulfide, ethyl chloride, aniline vapors, and all compounds that do not react with soda-lime. An all-soda-lime canister is recommended for hydrocyanic and hydrochloric acids, hydrogen sulfide, sulfur dioxide, and other acid gases. The canister mixture used during the war is actually best for phosgene and chlorine since the charcoal not only absorbs these gases but acts as a catylist in forming hydrochloric acid, which in turn is absorbed by the soda-lime.

Ammonia fumes again require a special chemical absorbent such as "kupremite," which was developed at the American University Experiment Station. This compound furnishes complete protection against two-per-cent ammonia for periods of five to seven hours; and owing to skin irritation no higher concentration than this can be endured at all.

Since the close of hostilities the Chemical Warfare Service has had many inquiries regarding the use of army gas masks for all sorts of purposes varying from the protection of workmen engaged in changing quicksilver retorts, to the alleviation of the lachrymatory difficulties encountered in peeling onions. Many of these demands are for purposes for which the army type of mask is absolutely worthless, either because the toxic gas is not removed by the absorbents in the canister or because there is not sufficient oxygen in the remaining atmosphere to support life even though this removal be effected. Typical demands of this class have come from telephone companies that have to send workmen to underground conduits containing leaky gas mains; from by-products recovery plants; from iron and steel companies, from protecting men from gas on the blast-furnace top and while making repairs on stoves and flues; from gas-producer and water-gas installations, for protection against carbon monoxide; from petroleum companies, for the protection of men entering storage tanks or tank cars that contain gasoline vapor; and from coal mine operators for protection against the carbon monoxide that follows mine fires and explosions.

In most of the above cases, indeed, the poisonous constituent is carbon monoxide. Even when a suitable mask against this gas is developed, which will undoubtedly be in the near future, its use will be restricted in general to places that have a fair degree of ventilation, as outside and atop of blast furnaces and stoves. The regular oxygen breathing apparatus will always have to be used for entering a gas-filled stove or flue.

Another large industrial demand has emanated from the numerous ammonia refrigerating plants, as various special masks and helmets now on the market are either inefficient or cumbersome. There have also been a number of inquiries from smelters, in the way of protection against sulfur dioxide and arsenical dust. To determine what help the masks would afford in this direction, a copper company at Butte was supplied with several masks which were used successfully by iron workers in making repairs on a Cottrell precipitator; this contained so much sulfur dioxide, even when cut off from the roaster during progress of the work, that unprotected men could not enter.

An all-soda-lime canister with army gas mask has been found very useful by the Department of Agriculture in connection with the fumigating of fruit trees and warehouses with hydrocyanic acid gas. This type of mask

(Continued on page 429.)

THE GAS MASK IN INDUSTRY
(Continued from page 427.)

has satisfied similar requirements for protection from acid vapors and gases such as hydrochloric acid and the oxides of nitrogen used in the manufacture of explosives and chemicals. Masks with special all-charcoal canisters have also been found effective in various industries where volatile organic solvents are distilled.

THE STORY OF THE BARTRAM OAK
(Continued from page 422.)

Arbres Forestiers de l'Amerique Septentrionale," published in 1810, and again in English in 1819 under the title "The North American Sylva," in which work Michaux describes and comments as follows upon what he calls the "Bartram Oak:"

QUERCUS HETEROPHYLLA. Q. folius longa petiolatis, integris vel inaequaliter dentatis, glande subglobosa. Every botanist who has visited different regions of the globe must have remarked certain species of vegetables which are so little multiplied that they seem likely at no distant period to disappear from the earth. To this class belongs the Bartram Oak. Several English and American naturalists who, like my father and myself, have spent years in exploring the United States and who have obligingly communicated to us the results of their observations have, like us, found no traces of this species except a single stock in a field belonging to Mr. Bartram on the banks of the Schuylkill, four miles from Philadelphia. This is a flourishing tree, 30 feet in height and 12 inches in diameter....I was at first disposed to consider this tree as a variety of the laurel oak...but the leaves of that species are never indented, and not a stock of it exists within a hundred miles of Philadelphia."

The old Bartram farm passed into the possession of other parties after the death of the original proprietor, and about the year 1840 the tree was cut down - inadvertently, according to all accounts. However, some seedlings grown from acorns collected from the tree were preserved on the property and elsewhere in Pennsylvania at West Chester and Marshalltown; and this progeny served to perpetuate the species - if species it was - and to continue the interest in and the study of it. Nearly every American botanist of note, and a number from abroad, had visited and examined either these trees or the parent stock, or had seen specimens of the leaves or acorns obtained from them; but the opinions expressed in connection with them were as diverse and heterogeneous as the trees were heterophyllous. Some, in common with Michaux, were disposed to regard them as representing a distinct species of oak, others contended that they constituted merely a variety or an anomalous form of one or another of the bristle-tipped species, and not a few argued in favor of their probable hybrid origin.

In the year 1855 a tree closely similar to, if not identical with, the Bartram Oak was discovered at Mt. Holly, N. J., and subsequently others, either individuals or small colonies, were found at widely separated localities in Delaware, Maryland and further south. Finally, in 1888 the tree was identified even in southern New York, on Staten Island. But these discoveries failed to solve the problem of the botanical status of the trees, and discussions in ragard to their probable specific, varietal or hybrid rank continued. In each instance, however, one fact was noted the significance of which could not be ignored: the Bartram Oak was invariably found in company with or in close proximity to trees of the willow oak. Eventually there was a prevailing consensus of opinion that it

(Continued on page 430.)

THE STORY OF THE BARTRAM OAK

(Continued from page 429.)

must be either a variety of the willow oak or a hybrid of which the willow oak was one parent; but in regard to the other parent authorities continued to differ.

However, the modern botanist is inclined to be more or less impatient of theorizing and guessing in places where exact experimental methods may be employed for the determination of facts. So those who were connected with the New York Botanical Garden decided that the logical and obvious thing to do would be to collect and grow acorns from a typical heterophyllous tree and carefully note the results. If the tree was a hybrid some of the seedlings from it should show a preponderance of the characteristics of one parent, some a preponderance of the characters of the other, and in the remainder the characters of both parents should be more or less equally apparent.

In the autumn of the year 1905 about 75 acorns were collected from one of the typical Bartram oaks on Staten Island, and these were planted in the propagating house of the Garden. About 50 germinated and the following year these were available for observation and study. As soon as the earliest leaves appeared it was evident that the little trees possessed considerable individual foliar diversity, and as their growth developed these diversities became more and more marked. At the end of the second year the leaf characters were well defined; and they told, in unmistakable terms, the story of the parentage of the tree from which the acorns were collected. The little trees were transplanted and arranged in a series, at one extreme were those all of whose leaves simulated the narrow entire form of the willow oak, at the opposite extreme those whose leaves could hardly be distinguished from the broad lobed ones of the red oak, while between were numerous heterophyllous forms in which the characters of the two species were blended in every conceivable gradation. The Bartram Oak, after 175 years of doubt and controversy, was conclusively proven to be a hybrid, with the willow oak and the red oak as the two parent species.

Six trees were selected for permanent display in the oak plantation of the Garden, where they were arranged with a red oak at one end, a willow oak at the other, and the hybrids in their places between. During the next few years two significant facts developed: the willow oak died and the hybrids that simulated it the most closely were noticeably less vigorous than those in which the red oak characters were most pronounced; and this latter fact may be verified by anyone who may be sufficiently interested to visit the oak plantation at the present time.

The question will naturally be asked, however, "what is the special significance of this fact?" It is evident that the willow oak type is the least vigorous, but why? If we examine into the natural geographic range or distribution of the two species, the answer is obvious. The red oak ranges from the Gulf of Mexico to Nova Scotia. The willow oak reaches its farthest northern limit of natural distribution in Staten Island. It is essentially a southern species, a native of the warm sandy soil of the Atlantic coastal plain; the climatic and soil conditions of the Bronx are uncongenial and unsuited to it. The heterophyllous trees which approach the red oak type, however, appear to be healthy and vigorous and destined to grow to maturity.

Incidentally it may also be mentioned that a flourishing ten-year-old tree, with typical heterophyllous foliage, transplanted when a one-year-old seedling from

(Continued on page 431.)

PRESERVING WITHOUT SUGAR

(Continued from page 430)

The fruit was first carefully washed, the water being changed several times in order to remove as thoroughly as possible dust and other impurities adhering to the surface. It was then placed in the jars of water, care being taken that no bubble of air should remain within the jar when it was closed and the air-tight condition being insured by a strong rubber band.

Within a day or two some of the jars showed signs of a more or less lively fermentation with an expulsion of liquid by means of the gas produced. Upon examination this fermentation was found to be alcoholic in character. Some of the other jars exhibited the same sort of fermentation during the course of the following week; and from time to time during the summer, during the autumn and even during the winter a jar was found to have leaked. Such cases, however, became increasingly rare and in the early summer of this year there remained seventeen of the forty-two jars in a perfect state of preservation, three in which there were merely a few small bubbles of gas, having a total volume of about one cubic centimeter, and one in which there was a bubble beneath the stopper, having a volume estimated at from three to five cubic centimeters. In these four latter jars the bubbles had long been present and had increased in size with extreme slowness, the liquid, meanwhile, remaining as clear as in the seventeen perfect jars.

Mr. Bertrand's explanation as to the mechanism of this process of conservation is highly interesting from a scientific point of view. He points out that as soon as the jars are filled with the fruit and the water as described, an osmotic exchange immediately begins to take place. The fruit begins to absorb a certain amount of the water which surrounds it, while on the other hand there is a slow diffusion into the water of the salts, acids, sugars, diastases, etc., con-

(Continued on page 435.)

THE STORY OF THE BARTRAM OAK

(Continued from page 430.)

the Staten Island locality, is growing in the Brooklyn Botanical Gardens, and two others of about the same age, obtained at the same time and place, were transplanted to and are growing in the grounds of the Staten Island Institute of Arts and Sciences at New Dorp The perpetuation of the Bartram oak in these boroughs of Greater New York seems, therefore, to be reasonably well assured, and it will be the privilege of future botanists to collect and grow acorns from these trees and their progeny, thus continuing the careful observations and studies of the inherited characters of hybrids, of which these trees represent the initial records.

THE FUSION OF TUNGSTEN

(Continued from page 410.)

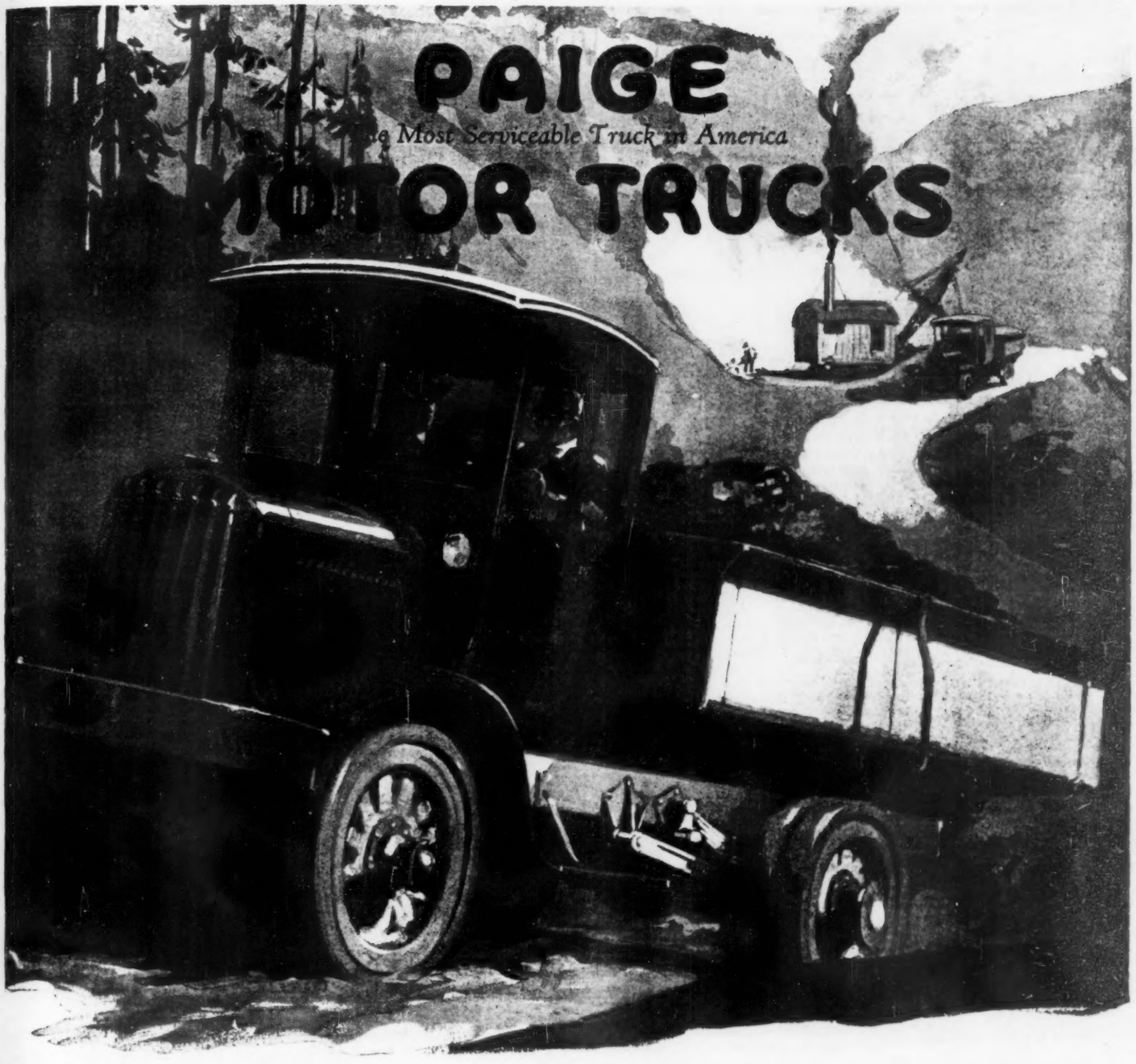
the making of crucibles. all this, however, is more a development for the future than is the use of tungsten as an abrasive; for during the war-time shortage of raw materials no attention could be paid to the possible chemical applications of tungsten.

There can be no question that tungsten will eventually dominate the tool-making industry, says Herr Lohman. According to the Moss scale again, the greatest hardness obtainable in tool steel alloys is 6.5, while we have seen that tungsten goes to 9.8 The making of tools of all sorts from pure tungsten in place of the alloys of this metal with steel or other materials is quite likely to justify the prophesies which Herr Lohman makes for it.

As mentioned above, wire for incandescent lamps is at present made from powdered tungsten by pressing and sintering. If a molten form of tungsten were at hand for making these filaments, the amount of current required per unit of light could be reduced, since fused tungsten is more effective as an incandescent resistant. Furthermore, for many years there has been an effort to obtain tungsten wire for electric heating apparatus and for pianos; and with a meand for producing the wire, this demand can be met. In particular, the present method is the first to afford any promise of fusing the tungsten into pieces large enough to give wires of all necessary gage. The process used in the preparation of a malleable tungsten for drawing to wire are likewise protected by patents in various countries.

Herr Lohman throws out a hint to the effect that the preparation of molten tungsten in suitable form for further treatment was extremely difficult owing to its high fusion point. We would have guessed this without his telling us so; it is ordinarily a safe assumption that a thing which everybody would like to do but nobody has been able to accomplish presents some conspicuous difficulty. He makes a more pertinent remark, however, when he says that the solution of this problem threw valuable light uponthat of the production of other metals, especially such ones as chromium, boron, titanium, vanadium and uranium, whose fusion points are high enough to place them in the same class with tungsten, and which before the discovery of the process for fusing tungsten were likewise difficult or impossible to obtain in molten condition and in the form required in industry. As a further logical consequence of the process invented for fusing tungsten, new ways for fusing even such metals as iron and steel have been devised which permit a much cheaper manufacture of these metals than did the old technique; and which are, indeed, of great importance with respect to the theory and practice of metallurgy in general.

(Continued on page 434.)



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THE FUSION OF TUNGSTEN

(Continued from page 433)

Herr Lohman speaks particularly of his success in fusing uranium. For many years the effort has been made in industry, especially in the manufacture of X-ray tubes, to obtain uranium in the molten state, because of the circumstance that when this metal can be used as the anti-cathode the action of the Roentgen tube is greatly strengthened. Uranium in the form of wire is also of great importance for many purposes in connection with manucacture of ordinary and optical glass.

THE TRANSCONTINENTAL AIR RACE

(Continued from page 423.)

rance. In the pilot's seat all ranks of the service were represented. The list included a Brigadier General, three Colonels, four Lieutenant-Colonels, twelve Majors and eight Captains. The balance of the entry was made up of First and Second Lieutenants and one cadet.

Of the 64 entries the majority consisted of the well-known DH-4, which was developed during the war for our armies in France. This machine is equipped with a 400 horse-power Liberty motor and is credited with a speed of 124 miles per hour. The list of entries included also eight of the SE-5 driven by a 180-horse-power Hispano-Suiza engine at a speed of 122 miles per hour; four Le Pere machines with the Liberty motor and a speed of 124 miles per hour; two Martin bombers with three 400-horse-power motors and a speed of 112 miles per hour; a Bristol Fighter of 115 miles per hour driven by a 264-horse-power Rolls-Royce engine; an Italian S V A machine with 260 horse-power motor and reputed speed of 134 miles per hour. An interesting entry was that of two captured German Fokkers driven by 100-horse-power Mercedes engines with a speed of something over 100 miles per hour.

At the present writint it looks as though the race would go to the man who won the recent New York-Toronto contest, Lieut. Belvin W. Maynard who, at the outbreak of the war, was a student in one of the theological seminaries. He enlisted in the Army Air Service and showed remarkable aptitude in the new profession. Maynard is credited with a very thorough knowledge of internal combustion motors and it is no doubt this, coupled with his all-around skill as a pilot, that has put him so far in the lead. Starting on October 8th from New York he reached San Francisco on October 13th, and after the regulation rest of 48 hours he set out on the return trip. If he maintains his present speed he should be back again at Mineola on Saturday the 18th, making the round trip of 5200 miles in ten days of daylight flying. His average net speed works out, according to all available data, as about 110 miles per hour - a truly wonderful performance.

At the present writing (with about three days for the leaders to complete the course) out of the 65 machines that started, 46 are still in the race and 19 are out for various causes. On Octiber 14th seven had reached San Francisco and five had reached Mineola from the west. A painful and serious feature of this contest is the fact that more than nine fatalities have been reported. According to General William Mitchell, Chief of Entries in Training in the Army Air Service, all of these men were killed in the De Haviland machines. On the other hand we have the fact that the men who are leading in the race, including Lieut. Maynard, are using De Havilands; and it is already evident that this machine with its Liberty motor will show the same incontestible superiority over other machines here as in the New York-Toronto race.

(Continued on page 436.)

PRESERVING WITHOUT SUGAR

(Continued from page 431.)

tained in the fruit. The water consequently becomes increasingly acid to the phtalein of phenol and even to helianthine; this causes it to be unfavorable to the the development of the great majority of species of bacteria, although it still permits to a certain degree the growth of yeasts and lactic ferments

To sum the matter up it may be stated that the conservation of fruit in cold water depends on the one hand upon the number, the nature, and the degree of vitality of the germs contained in the jars (since careful washing does not entirely free the fruit from the microscopic organisms adhering to its surface); and on the other hand upon the acidity of the fruit to begin with and particularly upon the intensity of the biochemical processes which occasion the disappearance of the dissolved oxygen. The reason why the sliced fruit keeps better than the whole fruit is doubtless because of the fact that the reciprocal exchanges between the water and the cellular juices are accelerated, so that the protective action is more rapid, thus better preventing the development of the germs.

PNEUMATIC SCRAPING MACHINE

(Continued from page 424)

mounted on ball bearings which allow it to turn easily. Provision is made on each end of beam for holding the scraper when not in use.

The trolley is mounted on the beam by four rollers, and it locks to the lower side of the beam as soon as air is admitted for the forward stroke. As air is released it unlocks and is then free to be moved on the beam as required.

When scraping surfaces it is generally customary to scrape first one way and then the other. There has been designed a turn-table to meet this requirement. The ball-bearing turn-table has a work-bench mounted on it, and the foot-plate is a brake which holds the table firmly in any position.

THE TRANSCONTINENTAL AIR RACE

(Continued from page 434.)

The majority of the fatalities occurred in landing. The De Haviland is a splendid performer in the air but its great weight and high landing speed appear to make it a treacherous machine near the ground. General Mitchell, testifying before the House Committee, declared it was "a ship the Army did not want;" and in addition to criticizing its landing qualities, he objected to the position of the pilot between the gas tank and the motor. He states, moreover, that later American machines have been developed that surpass the De Haviland both in speed and in safety.

The great lesson of the race is the necessity of providing the principal air routes of the United States with frequent and suitable landing places. These must be clearly marked so that they will be recognizable from the air. They should be not over 25 miles apart, and marked by a white circle not less than 30 feet in diameter. The fields do not need much extensive preparation. All that is necessary is that they be free from rocks, boulders and other irregularities; cleared of fences; and without telegraph wires. Each field ~~sh~~ should be not less than 1500 feet in width, with its longer axis parallel with the direction of the prevailing winds.

A STRANGE TRICK EXPLAINED

A very perplexing trick, of eastern origin, makes a plant in full flower develop from a seed in a few minutes. If properly carried out the trick is very striking, for it can be performed in the full view of the spectators without any elaborate apparatus. What the onlookers see is on the following lines:

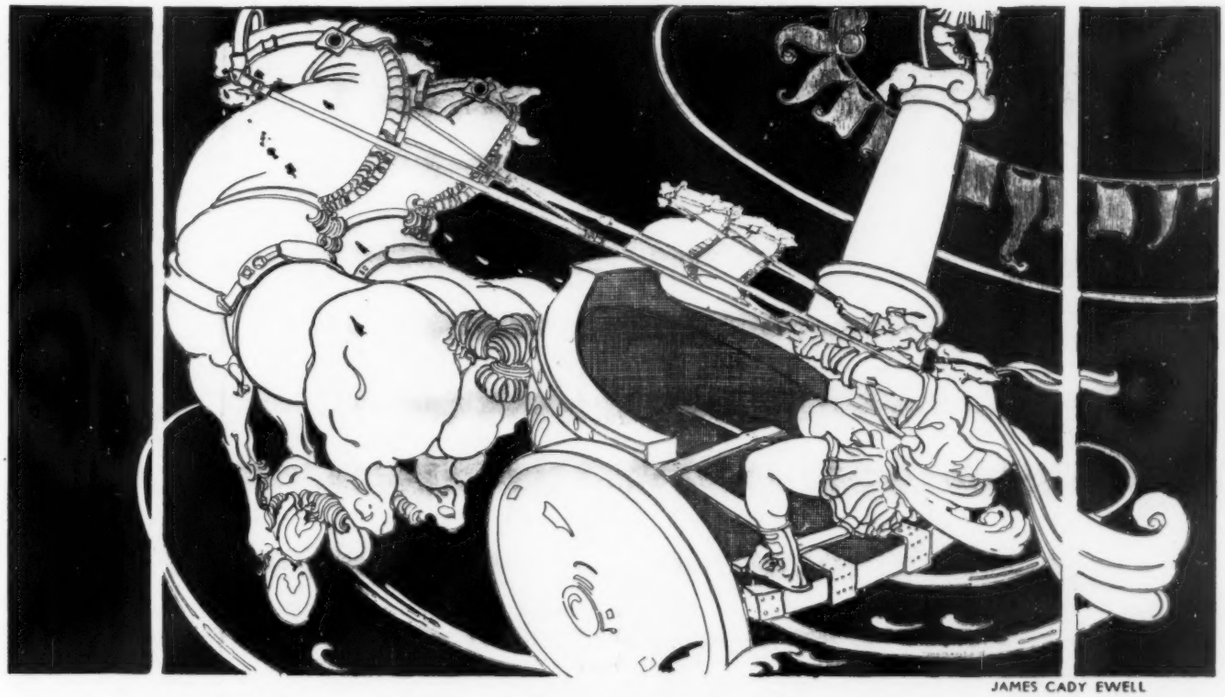
The seed is inserted in the middle of a pot of soil. Then the soil is watered and almost at once the plant arises from the earth. That it is a real plant is evident when pieces of it are picked and handed around to the audience.

The explanation is simple enough and it is needful only to make a few preparations in advance. In the first place a good-sized plower-pot is needed. As well, too, secure a jar that will fit inside the pot and, when in position, sink a few inches below the rim. Get a round piece of cork such as will just fit into the jar. It should, however, be able to move up and down freely. Then into the center of the cork push a stem of any plant bearing flowers and leaves. This should be rather short so that when the cork is in the jar the highest part of the plant is below the top of the vessel.

The jar may now be placed in the pot, and the cork with the flowering stem let down into the jar. Next cut a rounded piece of paper slightly smaller than the top of the pot. This should look as much like the soil as ppssible. In the center of this piece cut several slits crossing one another.

Fill soil all around in between the jar and the pot. Place the piece of paper right over thetop of the jar and adda layer of soil so that the whole thing is entirely covered.

To perform the trick a jug of water is needed. Push the seed down into the soil, then apply the water, being careful to pour it into the little trap door. Naturally the water goes down into the jar; and as the vessel fills the cork floats upward, bringing the flowering stem with it of course. After a little pause the whole thing comes with a jerk through the opening in the paper; and if this is the color of the soil the little flap will sink back at once and the deception will not be noticed. This forms a startling trick indeed. - S. Leonard Bastin.



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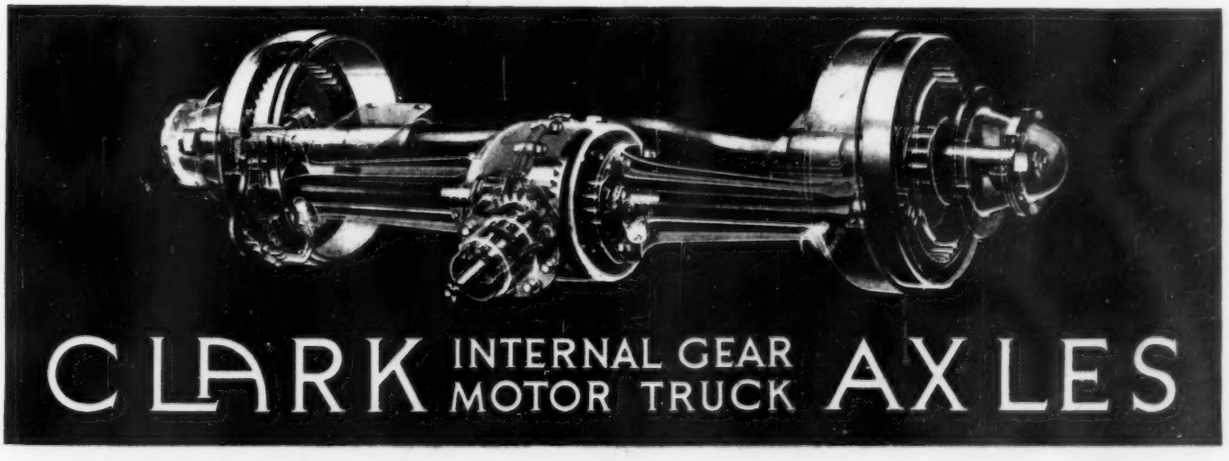

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